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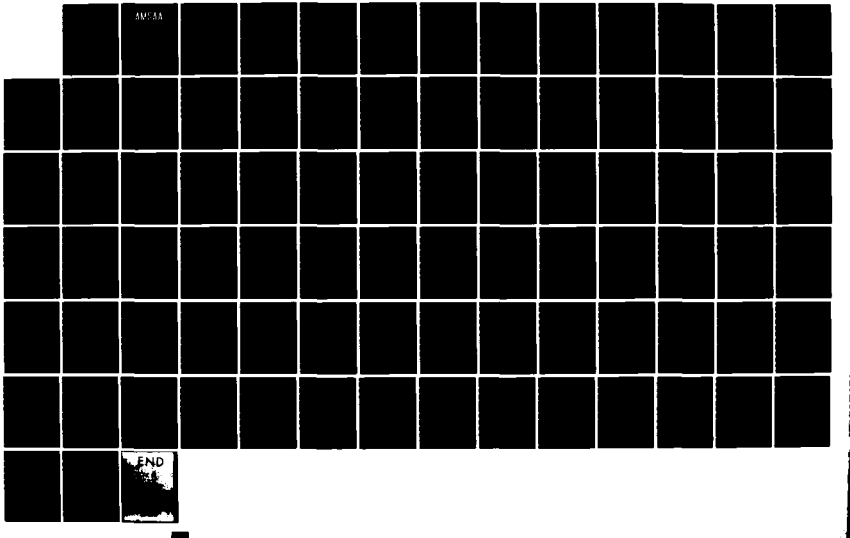

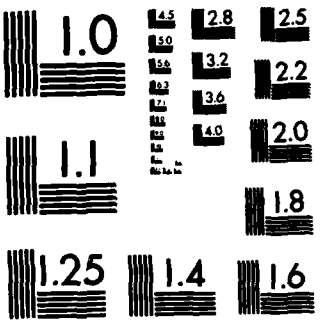

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LOGISTICS STUDIES OFFICE

PROJECT NUMBER 051

FINAL REPORT

EVALUATION OF THE USE OF THE NATO MAINTENANCE AND SUPPLY AGENCY (NAMSA) FOR DEPOT-LEVEL MAINTENANCE SUPPORT IN USAREUR

FEBRUARY 1984

U. S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY
LOGISTICS STUDIES OFFICE
FORT LEE, VIRGINIA 23801

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The North Atlantic Treaty Organization (NATO) Maintenance and Supply Agency (NAMSA) provides maintenance and supply services to member countries at a lower cost than can be achieved by an individual country alone. As a NATO member, the US has access to the Agency's services, but has made minimal use of these in the past. The study investigates the feasibility, costs, and benefits, principally in terms of sustainability, to be derived through expanding the US use of NAMSA. Recommendations are the initiation of action

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20. Abstract (continued)

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FEBRUARY 1984

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FORT LEE, VIRGINIA 23801

ABSTRACT

The North Atlantic Treaty Organization (NATO) Maintenance and Supply Agency (NAMSA) provides maintenance and supply services to member countries at a lower cost than can be achieved by an individual country alone. As a NATO member, the US has access to the Agency's services, but has made minimal use of these in the past. The study investigates the feasibility, costs, and benefits, principally in terms of sustainability, to be derived through expanding the US use of NAMSA. Recommendations are the initiation of action to employ NAMSA by paying for man-hours, parts, and equipment use. Subsequently, if the Project Manager of the Multiple Launch Rocket System is successful in removing legal obstacles to entry of the US into a Weapon System Partnership (WSP) committee, the US Army should negotiate for membership in the LANCE and TOW WSP committees.

Report Title: Evaluation of the Use of the NATO Maintenance and Supply Agency (NAMSA) for Depot-Level Maintenance Support in USAREUR.

Study Number: LSO Ø51

Study Initiator and Sponsor: US Army Materiel Development and Readiness Command
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A peer review of this report was conducted by Messrs. John R. Lenassi and Paul E. Grover of the Logistics Studies Office.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. Authority for the Study. Letter, DRCDM-S, DARCOM[1], Undated, Subject: NATO Maintenance and Supply Agency, DRCDM-S Task No. 83-11.

2. Problem Statement. To determine the extent to which the North Atlantic Treaty Organization (NATO) Maintenance and Supply Agency (NAMSA) should be used to perform depot level maintenance support of the US Army Europe (USAREUR).

3. Objectives. The objectives are to:

a. Investigate the full capabilities and limitations of NAMSA.

b. Determine the managerial control necessary for workloading NAMSA and the legal and procedural aspects of funds transfer for payment.

c. Conduct a cost analysis of NAMSA versus US Army (i.e., MZAD[2] and CONUS[3] activities) or CONUS contractor facilities for depot level repair of missile and communications systems components (i.e., optics and electronics).

d. Evaluate the impact of expanded use of NAMSA on existing MZAD and CONUS capability.

e. Identify the qualitative advantages and disadvantages of expanded use of NAMSA.

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[1]US Army Materiel Development and Readiness Command
[2]Mainz Army Depot
[3]Continental United States

4. Limits and Scope.

a. A briefing of the findings and conclusions must be presented on 1 Feb 84 (90 days after initiation of the study), and the completed study must be forwarded for printing on 1 Mar 1984.

b. System components selected for cost analysis must have fiscal histories at NAMSA, in CONUS, and, if possible, at the predecessor missile repair organization of MZAD [the Pirmasens Missile Repair (PIMR) Activity].

c. NAMSA capabilities and cost analysis comparisons are to be made exclusive of any additional capital investments at NAMSA.

d. The Multiple Launch Rocket System (MLRS) will not be a candidate for analysis since the US already plans to join the MLRS Weapon System Partnership (WSP) committee. MLRS also fails to meet the acceptance criteria of paragraph 4b above.

5. Methodology. The study will be accomplished through site visits, interviews, and accumulation of cost data from NAMSA, PIMR Activity, and Anniston Army Depot.

6. Findings and Conclusions. Use of NAMSA to perform depot level repair of USAREUR-generated LANCE and TOW unserviceable electronic and optical items is practical. Expanded use of NAMSA will create enhanced sustainability for USAREUR forces and lead to some savings on spares procurement, but only minor improvement in long range readiness.

7. Recommendations. Initiate action to use NAMSA to repair all of TOW and LANCE unserviceables generated in USAREUR, by paying for man-hours, parts, and the charge for use of the Agency's equipment.

Subsequently, if the MLRS Project Manager is successful in removing the legal obstacles to entry of the US into a WSP committee, the US Army should negotiate to enter LANCE and TOW WSP committees.

MAIN REPORT

CHAPTER ONE

INTRODUCTION

1. Background.

a. A US foreign policy objective is to increase the self-sufficiency of other free world nations through military aid and sales programs. However, such programs often lead to dependence on US sources for support. For self-sufficiency, nations should be capable of providing for a majority of defense requirements from within their own industrial, economic and technological base. Within the North Atlantic Treaty Organization (NATO), the NATO Maintenance and Supply Organization (NAMSO) exists to provide effective logistics support for common weapons systems and equipment operated by two or more NATO countries at minimum cost to those countries. This concept of operation contributes to member country self-sufficiency. However, for systems developed solely by the US or in which the US was a member of a joint development effort, the forces of the US Army Europe (USAREUR) generally are equipped prior to other NATO countries. When this happens, USAREUR units often need and develop support before the other NATO nations. However, as other nations become equipped, USAREUR support is not made available for maintenance of their new items.

b. NAMSO was established at the initiative of the US in 1958. NAMSO is the policy-making body, while the NATO Maintenance and Supply Agency (NAMSA) is its executive agent. The purpose for

their creation originally was to act as a funnel for supply of Grant Aid equipment from the United States to the NATO nations. NAMSA is subordinate to NAMSO, which is in turn subordinate to the North Atlantic Council.

c. Depot level maintenance often was found to be quite expensive for individual NATO members to perform within their respective countries. This was because of the large capital investment required for sophisticated test, maintenance, and diagnostic equipment needed for the newer systems. NAMSA now has the capability for accomplishing this level of maintenance. However, the NATO customers must fund the required capital investment and pay the operating costs applicable to the repair of their own equipment. This opportunity to share investment costs with other countries may lead to a decision by the US to use NAMSA under a joint logistics concept.

d. USAREUR, especially the 200th Theater Army Materiel Management Center (TAMMC), has expressed a desire to use the NAMSA capabilities for depot level repair of certain electronic items and optical components. In the future, if expectations are realized, other commodities may be added. The assumption underlying the desire to use the Agency is that turn-around time will be decreased, thus contributing to better readiness for USAREUR forces. Also, as a NATO member, the US Government may have an unwritten obligation to support NATO organizations insofar as practical. Headquarters USAREUR currently has the authority, and is developing the system, to use the facilities of the Agency for

overflow from assigned direct and general support maintenance units, and believes that expansion to encompass depot level repair is highly desirable.

e. During the time frame immediately preceding this research, the Army supply and maintenance system was in a state of change. The missile repair facilities in Germany were removed from command and control of the Army Missile Command (MICOM) and transferred to Mainz Army Depot (MZAD), concurrent with the establishment of DARCOM-Europe[4] at the beginning of FY1983.

f. Current tentative plans are for NAMSA, in the 1986 time frame, to perform 100% of the necessary depot level electronics repair for the Multiple Launch Rocket System (MLRS), now being deployed in Europe, and to provide direct exchange services and mutual emergency support. It appears that the MLRS will be the first NATO system in which the US becomes a member of a Weapon System Partnership (WSP) committee. This membership will serve as a test for newly developed management mechanisms applicable to US use of the Agency's capabilities. Other countries now participating in this WSP committee are France, Germany, Italy, and the United Kingdom. The US will not be using the Agency's capabilities to stock user and direct support repair parts, to perform excess and surplus redistribution, or to execute brokerage procurement. Depot level repair of automotive and hydraulic subsystems and components of MLRS

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[4]US Army Materiel Development and Readiness Command - European Headquarters

will be performed by MZAD in West Germany and Red River Army Depot in the US.

g. During 1981-1982, the NAMSA Utilization Test Action Plan (NUTAP) was conducted to determine if an "alternate use" capability existed at NAMSA. The test proved NAMSA's capability to perform depot level maintenance on TOW optical sights. The results of NUTAP were positive. The cost and quality of work compared favorably with that of Anniston Army Depot (ANAD). Repair turn-around time at NAMSA was superior to ANAD, and system readiness was substantially enhanced. However, US supply system procedures were less than satisfactory. NAMSA has been paid for the work done under NUTAP, but a billing, needed by the Depot System Command (DESCOM) to close the program file, has not yet been received from the 200th TAMMC.

h. MICOM has received requests from the 200th TAMMC to assign direct and general support overflow to NAMSA; MICOM has no objections, but considers this an internal USAREUR matter, which should be accomplished using theater funds from the Operations and Maintenance, Army, appropriations and theater procedures. Because of the capabilities demonstrated by NAMSA during NUTAP and the desire to create an additional source of repair during emergencies or crises, a request by the 200th TAMMC to assign some amount of depot level repair to NAMSA was made. MICOM has reservations with respect to depot level repair by the Agency. Missile system components are among the most reliable items manufactured, and densities, for many systems, are low, leading to relatively few repair requirements. If repair is to be divided between MZAD, NAMSA, and CONUS facilities, the

actual amount of work to be done may not be sufficient to support a warm base in the two US-controlled locations.

2. Purpose. The purpose of this study is to determine when and how to use NAMSA for maintenance of US materiel, and to develop control procedures necessary for proper fiscal and inventory accounting.

3. Objectives. The objectives are to:

a. Investigate the full capabilities and limitations of NAMSA.

b. Determine the managerial control necessary for workloading NAMSA and the legal and procedural aspects of funds transfer for payment.

c. Conduct a cost analysis of NAMSA versus US Army (i.e., MZAD and CONUS activities) or CONUS contractor facilities for depot level repair of missile and communications systems components (i.e., optics and electronics).

d. Evaluate the impact of expanded use of NAMSA versus use of existing MZAD and CONUS capability.

e. Identify the advantages and disadvantages (other than economic) of expanding use of NAMSA.

4. Limits and Scope.

a. A briefing of the findings and conclusions must be presented on 1 Feb 84 (90 days after initiation of the study), and the completed study must be forwarded for printing on 1 Mar 1984.

b. System components selected for cost analysis must have fiscal histories at NAMSA, in CONUS, and, if possible, at the predecessor missile repair organization of MZAD [the Pirmasens Missile Repair (PIMR) Activity].

c. NAMSA capabilities and cost analysis comparisons are to be made exclusive of any additional capital investments at NAMSA.

d. The Multiple Launch Rocket System (MLRS) will not be a candidate for analysis since the US already plans to join the MLRS Weapon System Partnership (WSP) committee. MLRS also fails to meet the acceptance criteria of paragraph 4b above.

5. Methodology. The study will be accomplished through site visits, interviews, and accumulation of cost data from NAMSA, PIMR Activity, and Anniston Army Depot.

CHAPTER TWO

DESCRIPTION OF THE NATO MAINTENANCE AND SUPPLY AGENCY

1. Background Information.

a. History.

(1) The problem of supplying parts for equipment of American manufacture led the US in 1957 to propose an entirely new approach - the development of an effective regional system for logistics support. Support functions, previously performed separately by each involved country, were delegated to a central organization.

(2) Thus, NAMSO was created as a subsidiary body of NATO. The organization consists of a Board of Directors, supplementing committees, and its executive agent, NAMSA.

b. Charter.

(1) The NAMSO Charter is the base line for NAMSO/NAMSA operations. Significant provisions are stated below:

(a) Only the North Atlantic Council can dissolve NAMSO, or revoke or amend its charter.

(b) NAMSO has the organizational, administrative and financial independence to carry out its mission.

(c) NAMSO supports common systems of NATO countries and performs those functions of management which can be accomplished in common more effectively than can be achieved individually.

(d) The NAMSO mission objective is to maximize effectiveness of logistics operations in peacetime and in wartime.

(e) Each NAMSO member country retains the authority to decide how much NAMSO service will be provided to it.

(f) NAMSO will provide service solely to the armed forces of NATO member nations.

(g) NAMSO is an integral part of NATO and is legally indistinguishable.

(h) Board decisions are based on a simple majority vote, except in cases having financial implications, changes to the general policy, or approval of staff selections. Then the decisions must be unanimous.

(i) NAMSO assets are normally NATO assets, but for Weapon System Partnerships, special arrangements for asset management, rights of participating nations, and financial accounting are established.

(j) NAMSO operations are no-profit and no-loss by activity and by program; this is in accordance with its charter as a non-profit organization.

(k) External audit is conducted by the NATO Board of Auditors.

(l) In time of war, the Supreme Allied Command Europe is prepared to accept responsibility for the formulation of operational directives to NAMSA. Execution by this Command must be with North Atlantic Council approval.

c. Organization.

(1) The organization of NAMSO consists of two levels:

(a) A "legislative" level (Board of Directors and Committees composed of representatives from each NATO country) which is responsible for the establishment of policies.

(b) An "executive" level (the Agency) responsible for policy implementation.

(2) The legislative level.

(a) The Board of Directors consists of a member from each NATO country, the US member being the Deputy Assistant Secretary of Defense for Logistics and Materiel Management. Representatives from the Secretary General of NATO and from the Supreme Allied Command Europe also attend the meetings. The Board's role is to provide policy guidance to the Agency and to oversee implementation. For each program, it specifies the exact mission of NAMSA. It also approves the annual manning level, the budget documents, and the grading of positions. Finally, it receives, analyzes and discusses reports from the Agency to assure that prescribed policies are correctly applied.

(b) WSP committees may also be created. They define the policy applicable to a particular weapon system program. The WSP committees thus have a certain delegated authority from the Board of Directors. This flexible arrangement has two advantages: Only those NATO participants who are in the WSP can define the policy to be followed, and the countries can send representatives who are experts in the particular weapon system and who are authorized to

make decisions. This does not diminish the role of the Board in assuring that the decisions are in conformity with the NAMSO Charter and its general policies.

(3) The executive level.

(a) NAMSA Headquarters in Luxembourg has a General Manager with four Directors for Organization and Administration, Finance, Logistics, and Procurement. Each Director also supervises a number of divisions, or program offices, which constitute the NATO Supply Center. Within this center, for each weapon system, a program manager is responsible for all aspects of Agency logistic support. A number of specialized divisions (Procurement, Finance, Transportation, Depots, etc.) provide services to the program manager. He is the point of contact in NAMSA for customers participating in his program. See Figure 1, NAMSA Organizational Chart on the following page.

(b) In addition, the Agency operates four other activities: Northern Depot (located at Capellen, Luxembourg), Southern Depot (southern Italy), HAWK Logistic Management Activity (Paris), and the NAMSA NIKE Training Center (Fort Bliss). The Northern Depot is equipped and staffed for in-house depot level maintenance of optics and electronics.

d. Personnel.

(1) NAMSO classifies its personnel into groups. The "A" group represents officer or General Schedule 9-16 grades while the "B" group is equivalent to the noncommissioned officer or lower civilian grades. The remainder are wage grade/laborer level with

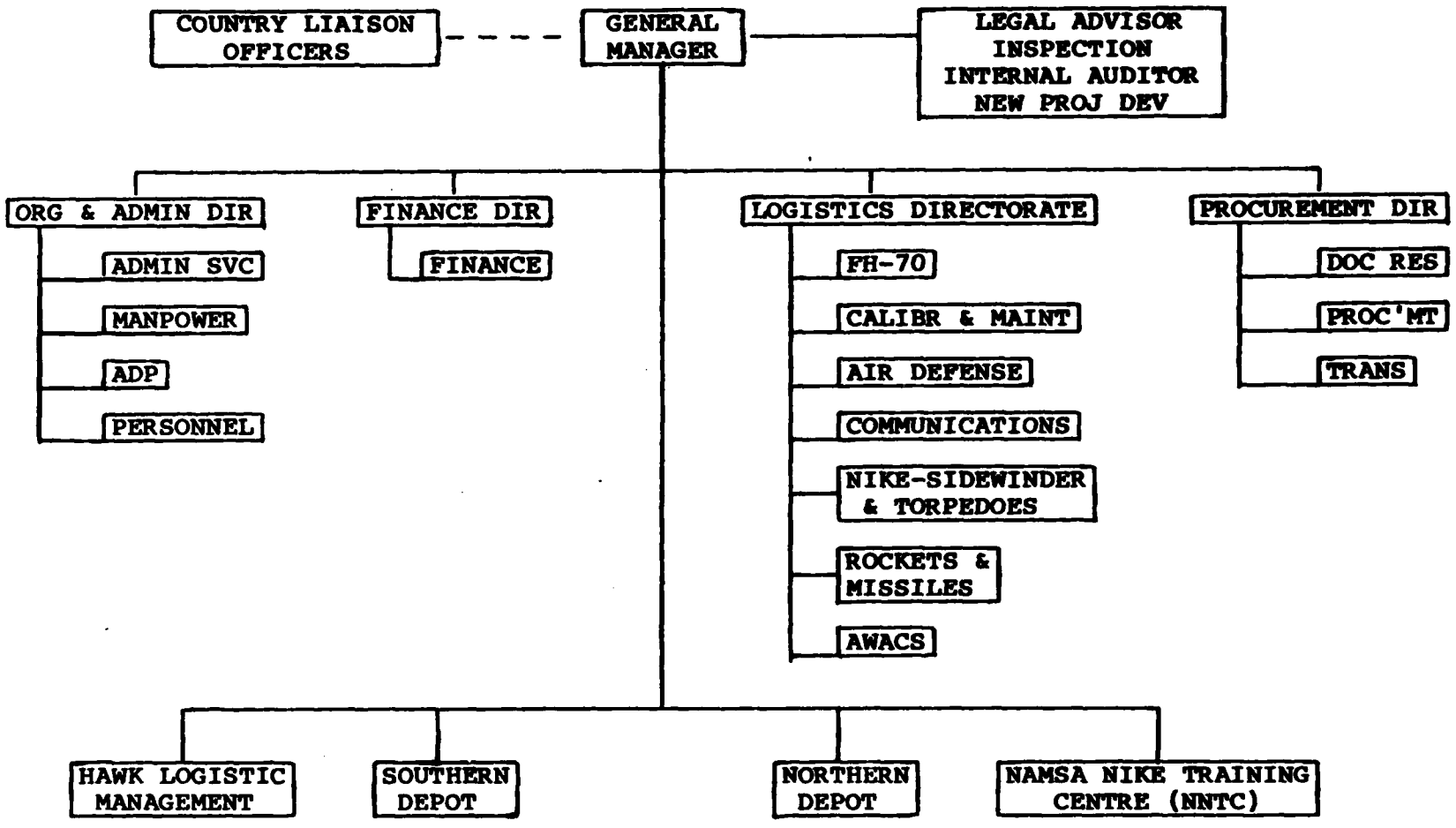


FIGURE 1. NAMSA Organizational Chart.

a distinction between those on NATO salary scales and those on local national pay scales.

(2) NAMSO personnel, in most cases, have NATO status and are employees of and paid by the Organization. Many of the management level personnel are military officers on leave of absence from their respective services. US personnel are in the Civil Service.

(3) Balance among nations is considered in recruiting the "A" grade staff. At NAMSA this balance is weighted by the volume of business received by the Agency from the various NATO members, and, where possible, is extended to the "B" group and the technicians. The majority of the laborer level are local nationals.

e. Operational Concepts.

(1) Program operations are based upon agreements reached by WSP committees or other participating nations' agreements. The operations reflect the desires of the NATO nations. The study team observed nothing that could be considered unconventional.

(2) The NATO nations retain their own logistics systems, except for using NAMSA as a wholesale source of supply and other services, and as a general support and depot level repair activity. The Agency is strongly missile, radar and communications oriented. It normally provides minimal direct support, but will, if requested and funded by a member country, stock the full range of required user or direct support repair parts.

2. Functions. NAMSA can be summarily described as an organization that operates under a modified industrial fund concept (non-profit), is owned by 14 different countries (including the US), and performs the functions of an international materiel manager using a weapon systems approach.

a. Procurement. NAMSA uses a source list of 11,000 qualified bidders, which could become an excellent tool for USAREUR identification of potential suppliers in time of emergency. Contracts are let for supply of repair parts and for maintenance of items for which no in-house capability exits. Although NAMSA has no small business set-asides, there may be other requirements. For instance, members of a WSP committee may request that their weapon system support contracts be placed in their own countries, if possible. Procurement requirements from all countries are consolidated, when practical. For example, if NAMSA already has a requirement to overhaul 100 turbine engines and Italy a new requirement to overhaul 50 engines, consolidation to 150 engines should produce lower bids than would procurement actions initiated separately. NAMSA does not presently have a USAREUR point of contact for consolidation of procurement or even for coordination of procurement. An officer may remain in USAREUR three years, but during this time he can be reassigned to several different positions. NAMSA states that coordination in this area is difficult because of this personnel practice. The US Army has reservations about using NAMSA's procurement services because:

(1) The procurement might be placed with a contractor located far forward within the Federal Republic of Germany; such a contract would build a warm base which might not be retainable during wartime.

(2) Since NAMSA charges for procurement services, the total cost of the items procured appears to be higher. Costs for their procurement services, or any other support services, are charged to the program for which the services are rendered, and these costs are separately identifiable. US procurement service costs are paid by the Operations and Maintenance, Army, appropriation and are therefore not separately identifiable, thus giving the impression of being "free."

b. Inventory management. Inventories are managed by system; therefore if an electronic component were purchased with funds from the TOW WSP committee, it would be stored in a different location from the same component purchased with funds from the LANCE WSP committee. If the TOW component is above the safety level and that component is needed by LANCE, it can be used subject to payback. NAMSA stocks 43,000 HAWK lines as opposed to USAREUR's 7,000. Discussion is now underway between USAREUR and NAMSA to establish procedures for supply from Agency stock and subsequent payment. Although the US has no financial interest in the ownership of this stock, it is NATO practice to assist US forces, where possible, if readiness of those countries which actually own the materiel will not be adversely affected.

c. Cataloging. This function is known as codification. It produces catalog data compatible with that of the Defense Logistics Services Center. The prices charged by NAMSA consist of the costs of the latest procurement plus an add-on for overhead. When the US sells to NAMSA, the price charged is the procurement cost listed in the latest Army Master Data File (AMDF) plus 3.5% accessorial surcharge, 5% administrative surcharge under a Cooperative Logistics Supply Support Arrangement, 1% asset use surcharge for issues from depot storage facilities, less .5% embedded second destination transportation costs (NAMSA pays actual transportation charges). When USAREUR buys from NAMSA, it must pay the Agency's price which includes US surcharges (if the item was purchased through Foreign Military Sales procedures), and an equitable portion of the Agency's operational costs. If an Army unit orders a part from the 200th TAMMC, it receives that part at the AMDF price, which does not include any of the surcharges. The price excludes all of the TAMMC's cost to order or store the item, the TAMMC operation being funded completely by the Operations and Maintenance, Army, and the Military Pay and Allowances appropriations. In summary, hidden appropriation funding "subsidizes" item cost; the actual cost (AMDF price plus "subsidy") and the NAMSA price should be about equal, but the Army customer may perceive real cost to be excessive.

d. Research and Development. NAMSA does a limited amount of in-house research and development. Most of this concerns replacement of tube-type electronic components, which are no

longer manufactured, with transistorized circuitry for the older communications and radar systems used by the Supreme Headquarters, Allied Powers Europe.

e. Maintenance and calibration. The Agency has facilities at its NATO Supply Center in Capellen, Luxembourg, for general support and depot level repair of optics and electronics; other maintenance support is by contract. Lens grinding and polishing of lenses (when necessary) is done by outside contract. The capability exists to remove dents from equipment boxes and to repaint them, so the returned items have a like-new appearance. Repair cycle float items may be available for rent while a country's unserviceable major items are in a repair shop. A direct exchange pool for many secondary items is available. Calibration services are performed both at the Northern Depot or by mobile teams. Currently, such services are provided to the 517th Maintenance Battalion of the US Army Test, Measurement and Diagnostic Equipment Support Group. An interview with the officers of 517th revealed that they were pleased with turn-around time, quality, and price.

f. Disposal. This is a marketing type operation in which NAMSA merchandises obsolescent parts from its stock and the stock of NATO countries that are phasing out a system to those planning its continued use. The selling of excess materiel to another country is called "redistribution," while selling on the open market is called "disposal." Although NAMSA's approach to disposal is flexible and unique, no legal precedence or basis for the US to use this service exists. Any agreement for services should therefore

specify that items which NAMSA determines are beyond economical repair be returned to US control for disposal action.

3. Political influence and its effect on NAMSA operations. Although political considerations are important to staff and employee selection, the actual operations are remarkably apolitical. NAMSA supported both Greece and Turkey during their Cyprus fighting. It continued to support Turkey during the US arms embargo. Priorities are controlled in peacetime by the WSP committees. During alerts, the General Manager of NAMSO initially sets priorities after consultation with the Supreme Headquarters, Allied Powers Europe. If the seriousness of the situation warrants, priority direction can come from the Supreme Allied Command Europe. There is no policy regarding the assignment of a higher priority for work required by a member country involved in a military action in which NATO as a whole does not participate. This issue did not surface during the Falkland Islands war.

4. Modified industrial funding. DARCOM CONUS depots operate with fixed prices, a concept which should be most useful for planning workload and for funding purposes. If a depot makes money in any one year, the prices are lowered in subsequent fiscal years, and vice versa. Such a depot operates at actual cost only when a period of several years is considered. However, NAMSA operates on an annual non-profit basis. Therefore, its services are billed at cost of parts plus labor plus a fair allocation of overhead, determined by a formula approved by the NATO members.

a. The amount of funds available to NAMSA is small when compared to that of a CONUS depot, hence their requirement for advance payment. CONUS depots, operating through the Industrial Fund, do not experience cash flow problems. The corpus of this Fund is augmented with customer funds at the time maintenance PRONs (procurement request order numbers) are obligated. In the past, the US government attempted to deal with NAMSA as it would an ordinary contractor. However, with passage of Public Law 96-323, the US recognized NAMSA as a special entity, and advance payment can now be authorized by the Office of the Secretary of Defense (Comptroller).

b. For contracts with NAMSA which are cancelled with over six months remaining, termination costs include six months of labor costs plus the usual charges associated with cancellation. For contracts with less time remaining until completion, the labor costs charged are from time of cancellation to normal expiration time of the contract. If contracts are to be renewed annually, the renewal must occur six months prior to expiration, or delay in the restart may result.

CHAPTER THREE

EXISTING US MISSILE REPAIR FACILITIES

1. Mainz Army Depot and its PIMR Branch.

a. History.

(1) MZAD was established in 1951 as Mainz Ordnance Depot, a government-owned, government-operated facility. During 1956 it was converted to a contractor-operated activity. In 1976 it became a subordinate depot of DESCOM. Currently, the contractor is Mainz Industries Panzerwerk GmbH [Armor Work Industries, Inc].

(2) The PIMR Branch had its origin in the Airborne TOW USAREUR Repair Facility in 1976 in Mannheim. An additional facility was established at Pirmasens in 1978; the Mannheim facility then was moved there and consolidated to form the PIMR Activity. From then until 1981, the facility expanded to include depot level maintenance for I-HAWK, TOW/COBRA, DRAGON, STINGER, and Ground TOW. The PIMR Activity, as it was known while under the operational control of MICOM, operated for several years in an unusually flexible manner. If HAWK maintenance was causing a drop in readiness posture, Letterkenny Army Depot furnished expert HAWK repair personnel to the PIMR Activity; after a concentrated maintenance effort, these personnel returned to Letterkenny. If the next most troublesome system was LANCE, technicians from ANAD were moved in temporarily for an intensive maintenance effort, later to return home. The PIMR Activity was not hampered by an inflexible Table of Distribution and Allowance, which is truly efficient only under conditions of constant workload.

b. Capabilities. MZAD currently repairs and overhauls combat vehicles, major assemblies, and rubber products for USAREUR. It also performs supply operations such as receipt, storage, issue, and direct exchange of selected items. Limited missile electronics repair is performed at the PIMR Branch, which is now under the command and control of MZAD. Currently, there is an effort to expand the depot to include the repair of selected missile electronics and optics. In this expansion, the PIMR Branch facility located at Pirmasens will be relocated to MZAD in the recently acquired bus plant. At that time, the capability to repair some missile electronics and optics will exist. At present no US depot level repair capability for the LANCE missile system exists in Europe. All depot level electronic repair for this system is performed at ANAD.

CHAPTER FOUR

READINESS, SUSTAINABILITY AND THE WARM BASE

1. Definitions.

a. Operational Readiness refers to having all systems functional prior to and on D-day, or the day national mobilization is declared.

b. Sustainability is the sequential complement of readiness. It refers to keeping systems operational in a wartime environment.

c. The term "Warm Base" has its origins in Smokestack America and the mass production line. Usually, it refers to an established production line that is well into the learning curve and is operated by one shift of workers for 40 hours per week, although sometimes at a minimal production rate. The utility of a warm base is its ability to immediately support a rapid expansion of production after D-day. Since optics and electronics represent high technology rather than Smokestack America, the usual definition fails to lend itself to clear analysis. Therefore, for purposes of repairing these high technology items, a warm base is redefined as any repair facility capable of supporting immediate and rapid expansion after D-day.

(1) From their invention to the early 1950s, an electronic item consisted of vacuum tubes and other components affixed to a metal chassis. Fault isolation was done with voltmeters, oscilloscopes, and signal generators. Items were repaired by physical removal of defective components (tubes, resistors, capacitors) and their replacement, using soldering where necessary. In this era,

electronics were simple but, even so, fault isolation using available test equipment was quite difficult. The services of competent repairmen, possessing highly specialized knowledge of the items undergoing maintenance, were needed.

(2) Transistors and PCBs were introduced in the late 1950s, transistors replacing vacuum tubes and PCBs replacing a portion of the metal chassis. Equipment became more complicated and fault isolation more difficult. For LANCE this problem was solved by the development of a sophisticated test set (only three sets were manufactured, and they are now located at the US prime contractor's plant, ANAD, and NAMSA). The LANCE PCB is placed in a unique holder adjacent to the test equipment and tiny pins affixed to a unique plate are driven into the solder points underneath the PCB. Leads from these pins enter the test equipment and the repairman performs the prescribed test procedures, isolating the faulty component of the PCB. In essence, the test set, sophisticated though it may be, incorporates the diagnostic principles of the early 1950s into semi-automatic fault isolation equipment. Repair is accomplished by removing the defective component from the PCB and soldering in a replacement item. This operation requires a higher degree of skill with a soldering iron than does work on a hard-wired metal chassis as described previously. However, personnel skilled in soldering on PCBs are fairly easy to obtain. The point being made here is that the repairman must be skilled in operation of the test equipment,

whereas earlier an intimate knowledge of the item being repaired was necessary.

(3) The middle and late 1970s saw the introduction of Large Scale Integrated circuits, Very Large Scale Integrated circuits, and multi-layered PCBs, an example of which is a complete microcomputer containing only one meduim size PCB. Input and output signals enter and leave the PCB through numerous contacts at the board's edge. This represented a quantum leap in electronic technology, and perhaps an even larger leap in the difficulty of fault isolation. In response, a new type of testing was developed. A computer, running highly specialized diagnostic software, is connected to the PCB's contacts at the board's edge. The computer feeds input signals to the PCB and evaluates the PCB's output signals. When a fault is isolated, the computer provides the operator with a printout showing which component(s) to replace. After the repairman, using his soldering iron, makes the replacement, the PCB goes back to the computer for completion of testing. If the new component is good and if no other faults are located, the board is, for all practical purposes, like new. This type of equipment is widely used outside the Army and can be adapted to almost any PCB. It requires a computer, specialized software for each board to be tested, and connectors for the edge contacts of each board. (PCB's come in a wide variety of physical configurations.) In addition, the repairman needs to know how to operate the computer and how to couple the PCBs to it. He needs no specialized knowledge of the PCB being tested. Eventually, any PCB

with a dollar value high enough to be classified "reparable" instead of "throw-away" will be diagnosed using this technology.

(4) The usual definition of "warm base" is inappropriate when used in connection with PCB repair. A conclusion of this study is that one computer with appropriate software and PCB connectors, and one operator who runs only enough boards per week to maintain competence on the test equipment, does indeed constitute a warm base. After D-day the computer operator works full-time on fault isolation, simultaneously training second and third shift operators, while soldering, replenishment of bench stock, and paperwork are assigned to new hires. The one computer, its operator, and a minimal workload constitute a facility capable of supporting rapid expansion after D-day. The supply procedures used for turn-in and receipt of this minimal workload should be the same as those to be used during wartime.

2. A scenario for a European War.

a. NATO forces are beset with minor problems. The Red Army, which will incorporate the divisions of its satellites under Russian leadership, is beset with major problems. The communist political aristocracy has built a fence and minefield across Europe to assure that its subjects remain within their prison states. Historically, the Russian Army surrendered en masse to the Wehrmacht during its early assault on the Soviet Union. To successfully pursue the conquest of NATO territory, it stands to reason that the Russian leadership must believe that the Red Army can continuously and

rapidly advance along a broad front to a good position for re-establishment of the fence and minefield, at which time negotiations for peace might begin. Maneuver forward and backward, normally expected between forces approximately equal, could well result in disaster, with both Red Army Units (especially satellite divisions) and a portion of the imprisoned populations making a break toward a better life. Propaganda will lead those who prefer freedom to believe that they will be unable to get away because of the rapid advance of the Reds. The Rhine is the first major river obstacle to an advance and therefore a likely position for re-establishment of the fence and minefield, or at least a position where a pause is in order.

b. In consonance with this scenario, facilities offering sustainability will not be prime targets for either conventional or nuclear munitions. The reasoning is that Red plans must call for victory before the sustaining facilities can contribute much to defense (due to repair lead times), and their whole aggressive capability will be employed tactically.

c. MZAD is positioned next to the Rhine, well within range of indirect artillery and mortar fire from the East bank. Capellen is situated 85 miles west of the Rhine (see Figure 2 on the opposite page). ANAD is safe from attack except via intercontinental ballistic missile.

d. MZAD is located 85 air miles from the Fulda Gap; Capellen, 170 air miles. Attacking aircraft will have over twice as much exposure to air and ground defensive actions in a flight to and from

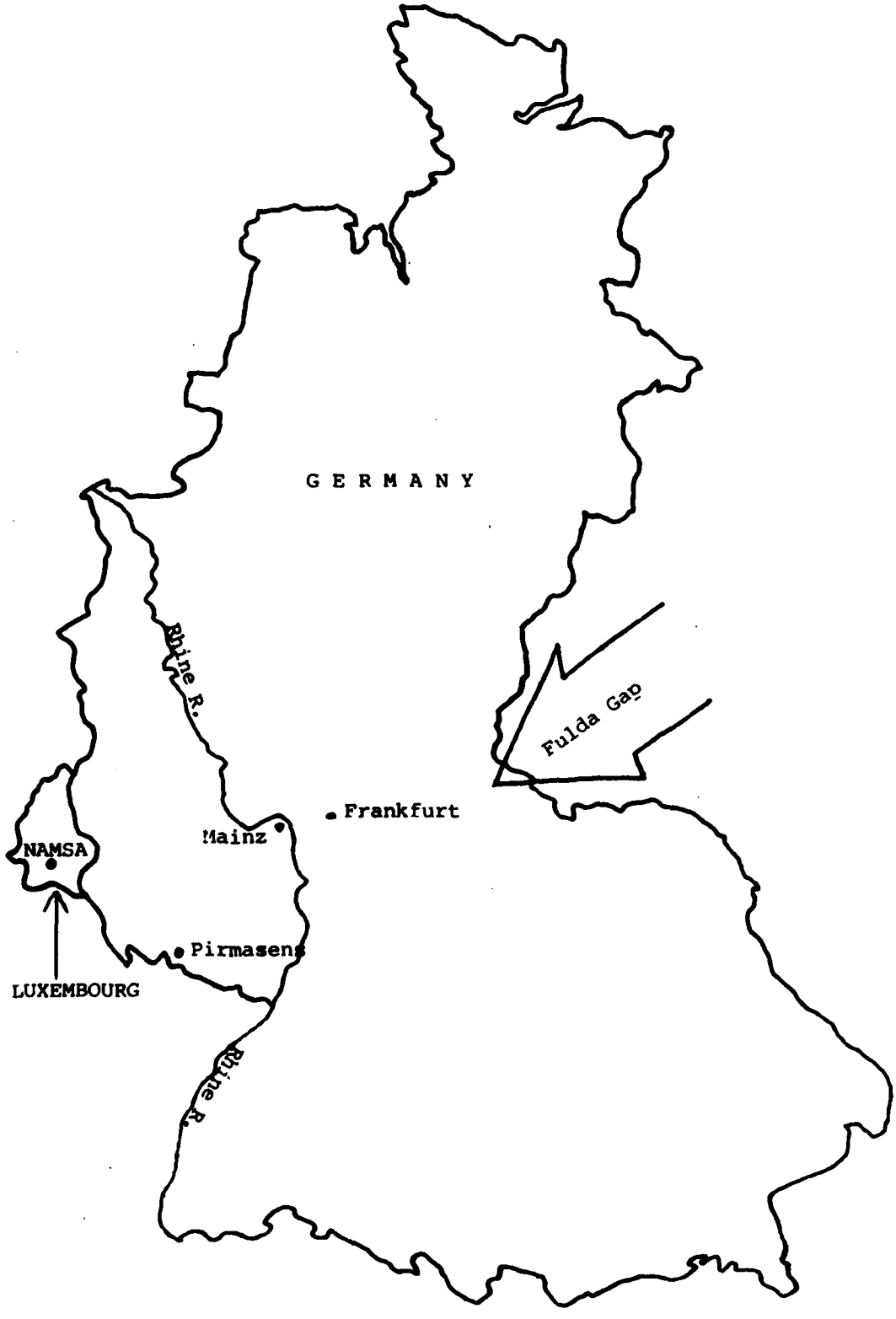

GERMANY
Rhine R.
Fulda Gap
Frankfurt
Mainz
NAMSA
Pirmasens
LUXEMBOURG
Rhine R.

FIGURE 2. Map

Capellen. The other side of this coin is that our logistics system must ship materiel farther for depot maintenance services.

e. ANAD occupies a safe position, but return of reparables to CONUS during hostilities has historically been poor. In the Viet Nam war, DARCOM (then Army Materiel Command) used every practical technique to facilitate the return of reparables, Closed Loop Support being the most notable. Improvement in the unserviceable return rate required time, management attention (both in CONUS and in theater), and adequate transportation to the rear. In a European war, time will not be available; management attention will not initially be directed toward return of reparables; and, return transportation (especially air) may well be clogged with personnel leaving the theater. Ocean shipping will be interdicted to some extent.

f. Currently, at the onset of conflict, MZAD's plan for the PIMR Branch is to pull the plugs, turn out the lights, and send the assigned US personnel home (CONUS). These plans will probably be revised, if possible, when the branch is physically moved to Mainz and expanded to include repair of optics. However, the fact remains that US civilian personnel do have a place to go which is far removed from air and ground attack.

g. NAMSA plans continued operations. Capacity will even be expanded by recall of retirees and temporary personnel, and other measures. Agreements are in force with NATO countries which require those countries to retain their military personnel in place at the Agency after D-day, and not to recall their civilian

employees for other duty. Most of their civilian employees simply have no safe haven in which to take refuge.

h. NAMSA alone has a source of emergency electrical power.

3. Readiness versus sustainability.

a. Most USAREUR personnel interviewed by the team placed emphasis on readiness. Sustainability was desirable, in their opinions, only if it did not reduce the readiness posture. They want all systems "go" on D-day.

b. MICOM personnel interviewed by the team emphasized sustainability, but not to the exclusion of readiness. MICOM's tilt toward sustainability may well be a measured response toward what they may consider USAREUR's excessive emphasis on readiness. They point out that the next war may be a long one or may not involve NATO, and they question NAMSA support under such a condition. They are also concerned that, if the depot level maintenance requirements of USAREUR are serviced by MZAD and NAMSA, sufficient reparables may not be available for CONUS depots to maintain skills. Finally, they believe that national item managers will lose asset visibility and the failure data needed to compute viable war reserve factors for reparables.

c. For existing systems, any factor which reduces turn-around time for unserviceable components will improve readiness. System readiness is largely influenced by the availability of the plug-in "black box." It is the repair of the unserviceable PCB which contributes to the availability of the box. Reparables for existing systems have been procured, insofar as practical, in the quantities

necessary for support by CONUS depot repair shops. Now, a change of support policy to more in-theater repair will shorten turn-around time and will make more reparables available for the direct exchange pool. This concept is depicted in Figure 3 on the opposite page. In-theater repair promises only a temporary surge in theater readiness, because the new repair leadtime will be used to recompute requirements, which will control subsequent procurement. The ten excess items, shown as direct exchange stock in the lower portion of Figure 3, must be attrited before more can be purchased.

d. For <u>future</u> systems, the requirements computation for reparable components will be made using the turn-around times available through in-theater repair; thus, smaller quantities of these items will be procured initially. Funds will be conserved for use elsewhere, but the readiness of these future systems will not be benefited by an excessive repair cycle quantity.

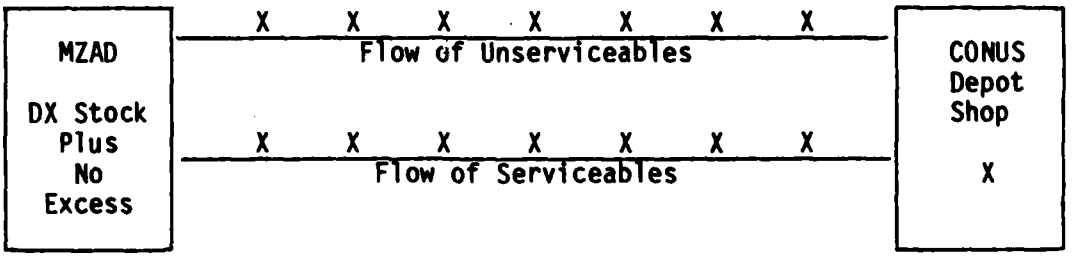
4. <u>Summary</u>.

a. Based on the preceding discussion, the conclusion drawn is that CONUS depots will suffer from lack of reparables after D-day. Long transportation times and associated uncertainties will degrade their ability to provide sustainability during a European war.

b. MZAD is ideally situated for providing readiness, but its location on the Rhine makes it an uncertain source of sustainability, as does its present policy of hiring only US civilians for missile repair.

BEFORE CONVERSION

Assumptions:
Failure rate = 5 widget PCBs per month ("X" is a PCB.)
Turn-around time = 3 months (CONUS depot)
Quantity procured for this pipeline segment = 15 PCBs



AFTER CONVERSION

Turn-around time = 1 month (NAMSA or PIMR Br)
Other assumptions remain unchanged.

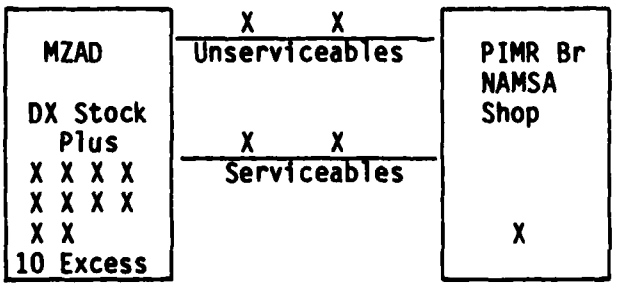


FIGURE 3. Example of Converting to In-Theater Depot Level Maintenance for an Existing System.

c. NAMSA at Capellen is a compromise. Its location, about three hours by truck farther away from most USAREUR units than is MZAD, would cause an increase in transportation time; but it does plan to remain operational and contribute to sustainability. Its location (farther back from the Rhine) removes it from many hazards of a fluid tactical situation. If justified by extreme urgency, helicopter transport of unserviceables and repaired items could eliminate some of the transportation time. The Agency's facilities, like those of the US Army, are above ground.

d. Because of the shortened turn-around times, in-theater depot level repair will enhance readiness temporarily for current systems.

CHAPTER FIVE

MANAGEMENT AND CONTROL

1. Procedures. Ideally, the long term goal should be to evolve a set of procedures which are so transparent that users of NAMSA's services would be unable to notice any differences between dealing with the Agency and dealing with a US government facility. Current US procedures and automated systems can be adapted to NAMSA requirements and vice versa; however, NAMSA opposes radical change because of the number of countries involved.

a. There are numerous variations in the procedures which can accommodate expanded use of NAMSA. Use of these measures should be considered "stop-gap" until the DARCOM standard procedures for depot level maintenance can be implemented.

b. A principle of Department of Defense item management is the assignment of an item to only one item manager, who becomes responsible for all aspects of the management of that item at the national level. If another organization manages a portion of an item - e.g., DARCOM-Europe chairs the annual MZAD workloading conference and manages depot level maintenance within Europe (a responsibility of the national item manager) - then that item has a de facto manager-and-a-half. The half-manager cannot see the whole national supply position for the item he is scheduling for repair. The following procedures should ultimately be placed in operation:

(1) MZAD should establish a custodial account for stock held in the depot but owned by MICOM (or another Command). When

unserviceable reparables are received by the depot or removed from a larger assemblage during direct exchange, the account is debited with the unserviceable receipt and MICOM is notified by the automated system. When serviceable replacements are issued from this account, MICOM is likewise advised.

(2) When unserviceables are shipped to NAMSA, the depot makes an adjustment in the quantity on hand, notifying MICOM of this action. When serviceables are returned from NAMSA, the same thing occurs.

(3) If it is uneconomical or impossible to repair an item, the depot initiates disposal action by classifying the item as Code 'H' (uneconomically repairable) in its custodial records. The national item manager then specifies the proper disposition.

(4) The procedures described are precisely those used by MICOM in dealing with CONUS depots, and the process is summarized in Figure 4 on the opposite page. They enable the national item manager, using the Commodity Command Standard System, to accumulate failure data concerning the item; increases or decreases in the failure rates will be reflected in increased or decreased requirements for war reserve stocks. The Logistics Control Activity will need to receive copies of the documents through the Defense Automatic Address System, and must adjust their software to include returns and recurring demand from within theater in the computation of unserviceable return rates. In-theater depot level maintenance, done on a repair and return basis outside the DARCOM standard automated systems, will lead to

DARCOM STANDARD AUTOMATED SYSTEMS

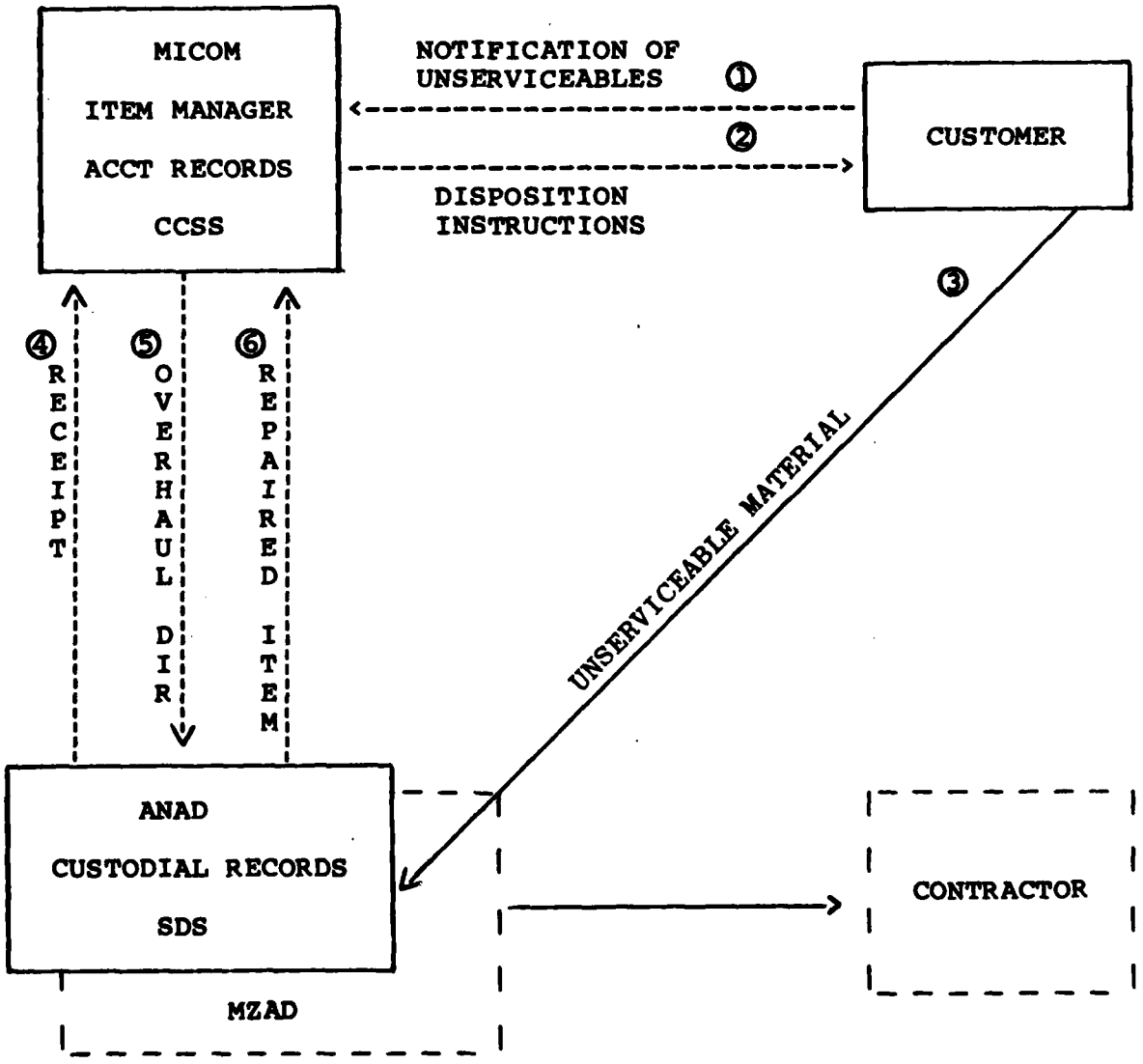


FIGURE 4. Flow of Material

a distorted picture at the national level.[5] The procedures described should apply to all items receiving depot level maintenance, not just missile PCBs and optics, and not just items in USAREUR.

(5) Installation of the Standard Depot System software at MZAD is planned during the January-March 1986 time frame[6] as a replacement for their current unique automated system. To incorporate these changes into the current software, anticipating only two year's usage, is not cost effective.

(6) Unserviceable reparables, accumulated by supply organizations other than MZAD and not designated for automatic return, would first be reported excess to MICOM, which would order shipment to MZAD or NAMSA. It might be advisable to furnish USAREUR a tailored version of the Automatic Return Items List, designating MZAD as the return destination for the appropriate items.

(7) Interim procedures can best be worked out by the 200th TAMMC, MZAD, DARCOM-Europe, and NAMSA. It will be impractical to develop procedures which cannot be faulted (by the manager-and-a-half concept) until the Standard Depot System is installed at MZAD.

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[5]This is a controversial point. It is being addressed in the Depot Level Reparable Action Plan (DELRAP); DARCOM point of contact is DRCSM-PSP (Rosenthal).

[6]Target dates for installation of automated systems have an historical record of slippage.

2. Flow of funds. MICOM, DARCOM-Europe, and USAREUR determine suitable requirements for depot level maintenance to be performed by NAMSA. MICOM prepares the procurement/work directive and obtains the funds, to be obligated when the US Army Contracting Agency, Europe completes the agreement (contract)[7]. This Agency, while processing the requirement, obtains approval for advance payment from the Office of the Secretary of Defense (Comptroller). MICOM releases the maintenance funds in accordance with the NAMSA agreement. The Contracting Officer's Representative could be the US Representative to NAMSA, but an appointment from US personnel at MZAD is preferable because the representative, although not an Agency employee, may be too close for objectivity. Actual payment can be made by any designated USAREUR finance office. This process is outlined in Figure 5 on the next page; note that the only step not completely routine is the request for approval of advance payment.

3. Program Status Reports. NAMSA can develop the capability of forwarding Program Status Reports via the MZAD Automatic Digital Network terminal. The data must be formatted by software either at MZAD or at NAMSA. If done at MZAD, Mainz Industries Panzerwerk GmbH must be paid for software development and computer time used; if done at NAMSA, payment must be made to them. Software

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[7]MICOM's obligation authority is received after the start of each fiscal year. An agreement covering unserviceable generations of current and prior years can be made with NAMSA at any time during the year, but these funds cannot be used to repair future year generations of unserviceables.

ACTIVITY	ACTION
MICOM/DARCOM-EUROPE/USAREUR	DETERMINE REQUIREMENTS
MICOM	WORK PROCUREMENT DIRECTIVE
USACAE	CONTRACT ----------> OSD COMPTROLLER
MICOM	RELEASE FUNDS
MAINZ ARMY DEPOT	CONTRACTING OFFICERS REPRESENTATIVE
FINANCE OFFICE	PAYMENT

FIGURE 5. Funds Flow Process

designed solely to reformat data is inexpensive and not considered a problem.

4. Legality.

a. The preferred method for using NAMSA is to join a WSP committee. This gives the US Army a voice in determining the range and depth of repair parts and the war reserve stockage policy, both of which ultimately impact heavily on readiness and on sustainability. It is initially the most expensive course because existing members of the WSP committee must be reimbursed for a portion of their initial capital outlay for repair equipment, initial stockage of repair parts, and bench stock. Thereafter, repair costs consist of man-hours, materials, and overhead (excluding depreciation). A close projection of these costs can be made by the Agency, based on their experience in such matters, but the actual costs per program or project are dependent on actual expenditures and actual work load.

b. The billing for the NUTAP project (TOW optical sights) was based on manhours, materials, and equipment usage. The usage charge was the estimated dollar value of the wear and tear on the equipment belonging to the TOW WSP committee; the payment was used by NAMSA as a credit to the accounts of the individual WSP committee members, serving to reduce their future costs to repair. The idea of an equipment use charge is not new, having been used for years by the US in the pricing of foreign military sales cases. It can be thought of as representing actual depreciation of equipment, as opposed to nominal or book depreciation. This method

of using the Agency creates problems: First, members of the WSP committee may have fears that the US is not paying its full pro rata share of costs; second, since the initial buy of repair parts was in sufficient quantity only for the support of the WSP committee's original equipment density, it may be necessary for the WSP committee to invest in more parts to adequately support their own and the US density of equipment; and, third, the US will have no voice in the overall support plan, including determination of war reserve quantities, for itself and the NATO countries. A variation of this method is a surcharge based on man-hours, which makes up for lack of an equipment use charge.

c. The third method by which NAMSA can be used is proper only when a negligible amount of work is to be done. The Agency performs the required service, charging only for man-hours and parts. For example, suppose a NATO member bought a TOW system for evaluation purposes and some maintenance was required. The cost of the paperwork to determine a fair charge for equipment usage could well exceed the receipts from the work. There is no foreseeable US requirement for this type of service, but it cannot be ruled out because a scenario similar to the preceding example could possibly occur at some future time.

d. Precedence exists for using method two on the previous page (paragraph 4b), and paying the equipment use charge. Method three above (paragraph 4c) is exactly the same as method two from a legal point of view, so the same precedence can be applied. The US has contracted for work during the NUTAP project and has

negotiated an ongoing agreement (contract) for calibration services.

e. No precedence exists for US entry into a WSP committee, i.e., using method one (paragraph 4a). As of today, the US plans to caveat its MLRS agreement with a reservation which indicates that certain facets of US participation are undergoing legal review and that full ratification of the document will be tendered upon completion of that review. Further, accommodations in the MLRS agreement may be required to facilitate full US participation in this Weapon System Partnership of five nations. At present the legal review is underway. If the US enters the WSP committee, it will do so under the provisions of the NATO Mutual Support Act, which imposes a $100 Million annual limit to host country assistance.[8] Since the limit can be changed, it should not affect a decision to use, or not to use, NAMSA.

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[8]Host country assistance [to US forces] is that quantity of goods and services procured by the US in NATO member countries for US forces stationed there. $75 million are now being spent annually by the US for purchases in Europe of petroleum, oil and lubricants in support of USAREUR.

CHAPTER SIX

COST AND IMPACT ANALYSIS

1. Cost Comparison of Circuit Board Repairs.

a. NAMSA policy specifies that both general support and depot level maintenance be performed for their non-US customers. US depots receive unserviceable items which require the whole range of maintenance to be performed, from user level to depot level. The items to be repaired by the depot may require minor maintenance, or considerable maintenance; frequency of repair is too low to provide significant statistical reliability. Therefore, costs to repair end items or their major components were considered inappropriate for cost comparison purposes. However, since PCB repair is always depot level maintenance, both at US installations and at NAMSA, the analysts reasoned that cost data at the PCB level could be used for valid comparisons. The results could then be used to project that NAMSA repair costs would be some percentage more or less than US depot repair costs.

b. A cost comparison of the repair of TOW and LANCE circuit boards at the PIMR Branch, NAMSA, and ANAD was conducted to determine if there was an economic advantage to be gained by repairing at one location over another. Five TOW and five LANCE circuit boards with the highest incidence of repair at NAMSA were selected for analysis. The circuit board NSNs and quantities of unserviceables repaired by NAMSA in FY82 were costed by NAMSA, to show the average unit labor and average unit materials costs. FY82 data were used to insure that data from all three locations would be

available. The cost information provided by NAMSA is shown in Table 1 for TOW and Table 2 for LANCE. The labor costs were the product of the man-hours expended on repair of an average board and the rate per man-hour. A man-hour spent on a TOW PCB costs $24.25, while a man-hour expended on a LANCE PCB costs $23.50. NAMSA man-hour rates are not direct labor rates. It should be noted that they include, in addition to direct labor, charges such as cost of indirect labor plus charges from all other applicable cost centers, e.g., automatic data processing costs. In FY82, both NAMSA and ANAD excluded from their rates any equipment use charge (which may be equated roughly with depreciation, as costed by the US Standard Depot System).

c. The same circuit board NSNs and quantities were provided to MICOM with a request for average unit labor and average unit materials cost. MICOM was able to provide the requested data on three of the five TOW circuit boards repaired at ANAD (see Table 1). The two TOW circuit boards for which data were not available are repaired at the Marine Corp. Supply Center in Barstow, California. The study team contacted this supply center and it provided the costs shown. MICOM was not able to provide data on the specified LANCE circuit boards repaired at Anniston. MICOM stated that no PIMR Branch cost data were available for either TOW or LANCE. LANCE items are not repaired by the PIMR Branch. While the PIMR Branch does repair TOW, MICOM stated that data were not available because "programs for those items that are repaired by

Table 1. TOW PCBs.

National Stock Number	NAMSA			ANAD		
	$Labor	$Mat'l	$Total	$Labor	$Mat'l	$Total
1430-00-464-1059	70.33	41.90	112.23	105.68	38.88	144.56
1430-00-464-1070	113.98	56.40	170.38	105.94	37.00	142.94
1430-00-490-0833	60.63	72.00	132.63	107.53	39.29	146.82
4935-01-012-0993	58.20	117.70	175.90	491.41	522.00	1013.41[1]
4935-01-012-9675	58.20	12.40	70.60	508.35	558.00	1066.35[1]

[1]Repaired at the Marine Corps Supply Center, Barstow, CA.

Table 2. LANCE PCBs.

National Stock Number	NAMSA			ANAD		
	$Labor	$Mat'l	$Total	$Labor	$Mat'l	$Total
1430-00-000-0087	51.70	8.40	60.10	175.43	133.18	308.61
1430-00-280-2175	54.05	14.90	68.95	190.22	7.68	197.90
1430-00-280-2180	42.30	7.50	49.80	264.20	94.64	358.84
1430-00-283-3498	37.60	7.60	45.20	79.26	13.38	92.64
4935-00-402-6950	235.00	87.20	322.20	886.39	211.22	1097.61[2]

[2]FY83 data used for ANAD.

the PIMR Branch are executed and reported on a 'bulk' PRON[9] basis by weapon system and data are not available on an individual NSN basis." However, the study team contacted ANAD and this depot was subsequently able to provide FY82 TOW and LANCE data which the depot stated were more realistic than that provided by MICOM. The ANAD data were used in the comparisons. LANCE data for this depot may be seen in Table 2. Subsequently the MICOM Missile Logistics Center was able to provide the average man-hours spent by the PIMR Activity on the repair of three circuit boards. Table 3 compares

Table 3. FY82 Direct Labor Hours for PCB Repair

National Stock Number	NAMSA	ANAD	PIMR Br
TOW			
1430-00-464-1059	2.9	4.00	5.2
1430-00-464-1070	4.7	4.01	4.7
1430-00-490-0833	2.5	4.70	4.3
4935-01-012-0993	2.4	14.5[3]	-
4935-01-012-9675	2.4	15.0[3]	-
LANCE			
1430-00-000-0087	2.2	6.64	-
1430-00-280-2175	2.3	7.20	-
1430-00-280-2180	1.8	10.00	-
1430-00-283-3498	1.6	3.00	-
4935-00-402-6950	10.0	33.55[4]	-

[3]Repaired by the Marine Corps Supply Center, Barstow, CA.
[4]FY83 data used.

[9]Procurement Request Order Number

the man-hours expended for the repair of circuit boards at the PIMR Activity, NAMSA, Marine Corps Supply Center, and ANAD in FY82. Though the rate varied among the circuit boards repaired at ANAD, it was approximately $26 for each direct labor man-hour expended.

d. Transportation of unserviceable PCBs from a USAREUR troop unit, through the direct or general support level, to MZAD is the first step in moving the PCBs to either NAMSA or ANAD. Individual PCBs or black boxes are brought to the direct or general support location and exchanged for serviceable PCBs or black boxes. Unserviceable PCBs are collected at the direct or general support level and periodically transported to MZAD as the central collection and depot level maintenance point on routine supply or maintenance runs. The cost of transporting the PCBs that will be charged to the PCBs in this first step will be zero since the routine resupply trips would be made with or without the PCBs. From MZAD to NAMSA, the unserviceable PCBs can be sent in three ways: using a US Army truck to deliver the boards to NAMSA; having NAMSA pick up the PCBs from MZAD at a cost of about $122 for a round trip (from the NUTAP study); or, using the German mail system at an approximate cost of $37.24 for first class registered mail, one way, for a 50 pound box of approximately 50 PCBs. For all three alternatives, the PCBs will have to go through customs going into and out of Luxembourg. The transportation cost of the first alternative would be absorbed by MZAD and would not be directly associated with the transported PCBs. From MZAD to ANAD either surface ocean shipping as part of a larger Army consignment or a Military Air Command flight from Frankfurt to Dover and US mail from there (Army Post Office, New York) are possible. For a box of

50 PCBs that is batched with a measurement ton for ocean shipping from MZAD to ANAD, the prorated cost would be about 30 dollars. (In the unlikely event that these 50 PCBs are not batched with other items going to ANAD, but sent as an individual box, the rate charged for these PCBs will be the full measurement ton rate of $241.29.) The cost of a Military Air Command flight from Frankfurt to Dover is charged to the US government but not directly to the PCBs. This only leaves the cost of registered first class mail (for 50 pounds) from Dover to ANAD, a cost of approximately $37.00. The shipping method will depend on the criticality of the PCBs shipped and, while both ocean shipping and Military Air Command or US mail will be used, the combination of military air and US mail is the more likely.

e. For the transportation of PCBs from MZAD to NAMSA and return, based on a consignment of 50 PCBs, the cost that would be attributed the PCBs ranges between $0 and $122. There is little handling involved. To transport the same consignment from MZAD to ANAD and return, the PCBs have to be delivered to Frankfurt and loaded, air freighted to Dover, unloaded, and sent to ANAD. The return of the PCBs will follow the same steps. The cost that can be measured and directly attributed to the PCBs is the CONUS mail charge of $74. The additional handling and pro rata air freight costs could not be measured but will increase the total transportation cost to be about equal to that for the upper limit, MZAD to NAMSA cost. While the MZAD to NAMSA transportation and handling cost is expected to be slightly lower than the MZAD to ANAD cost, the difference per PCB will be very small. Therefore, these costs were not included in the analysis.

f. The NUTAP study showed that a 30-day repair cycle could be expected from NAMSA while ANAD required from four to six months for optical sights. ANAD was contacted to determine if unusual circumstances dictated the 4-6 month turnaround time. The response was that for a new maintenance program, four months from conception of the requirement to "ready-for-shipment" was normal. However, only thirty to sixty days are required from the time that the optical sights and repair parts are on hand at ANAD until the sights are "ready-for- shipment." It should be noted that the NUTAP test was performed on a repair and return basis. While NAMSA normally performs maintenance on this basis for all customers not using their direct exchange service, ANAD normally repairs for return to DARCOM-owned stock when items are returned by customers. Therefore, a comparison of turnaround times on such a different basis is invalid.

Table 4. Turn-around Times for TOW PCB Repair in CONUS

National Stock Number	Months
1430-00-464-1059	1.6
1430-00-464-1070	1.8
1430-00-490-0833	1.9
4935-01-012-0993	5.5[5]
4935-01-012-9675	11.1[5]

[5]Repaired at the Marine Corps Supply Center, Barstow, CA.

g. MICOM was contacted for repair turnaround times for the five TOW circuit boards used in Table 1. These turnaround times are shown

in Table 4. Two circuit boards, as indicated in the table, are repaired at the Marine Corps Supply Center in Barstow, California, and the turnaround times for these include shipping time to and from there. MICOM states that the turnaround time is always unusually lengthy there. Shipping time is not included in the turnaround time for the other three circuit boards.

h. The NUTAP study showed that the quality of work to be expected from NAMSA was equal to that provided by ANAD. There is no reason to expect a quality difference between NAMSA and ANAD for circuit board repair.

i. Based on the data provided in Tables 1, 2 and 3, NAMSA appears to have a strong cost advantage over ANAD. The advantage on some items was so great as to make the data suspect. Both reviewed the data that they had provided and stated that it was correct. Both NAMSA and ANAD were provided with the other facility's data and asked to comment. Neither were able to reconcile any differences. The accounting systems were reexamined and the same cost elements were present in both. Finally, maintenance policy was reexamined. The differences between the NAMSA and ANAD man-hours and parts can be attributed to different maintenance policies. NAMSA receives black boxes containing the PCBs for periodic servicing. One or more of these PCBs may be faulty, resulting in the black box being unserviceable. The PCBs are each tested individually and, as a faulty one is located, it is repaired. In addition, those PCBs that are not faulty (i.e., still fully functioning), but that are out of tolerance because of a degraded resistor or other minor component, are brought back to specifications

by the replacement of that component. The end result is that the time and costs to readjust the functioning PCBs are averaged with the PCBs that are faulty, giving a lower average parts cost per PCB type and showing a lower average man-hour expenditure. Those PCBs that meet all specifications are not averaged in with the maladjusted or faulty PCBs. At ANAD, the PCBs are received individually and all are faulty (the black boxes are brought by the troop unit to the direct or general support level where faulty PCBs are replaced, the faulty PCBs then being batched and sent to ANAD). An illustration of this difference between NAMSA and ANAD maintenance policy may be seen in Appendix B.

2. Cost Comparison of TOW Optical Sights (NUTAP Study).

a. For NUTAP, every remaining serviceable component in each of 42 unserviceable TOW optical sights was replaced by an unserviceable component. The purpose of this action was to assure that NAMSA and ANAD both received sights which were in equal states of disrepair, insofar as possible. The cost to repair one of these particular sights was about five times the cost to repair an ordinary unserviceable sight at each location.

b. At the time of NUTAP, the ANAD accounting system did not include depreciation as a cost element, while NAMSA did include an equipment use charge (which equates closely to depreciation). Therefore, for cost comparison purposes it is proper to subtract the equipment use charge from the cost to repair at NAMSA. Comparative costs are displayed in Table 5.

c. The expectation is for NAMSA's cost of materials to be 10% higher than ANAD's because of FMS surcharges. However, NAMSA

Table 5. Cost Comparison per TOW Optical Sight [Given: Exchange Rate = 40 FLux/US dollar]

	NAMSA	ANAD
Materials	$2230	$2513
Labor	1173	939
Total	3403[6]	3452

[6]Equipment Use Charge of $281 is Excluded for Comparison Purposes.

subcontracted the grinding and polishing of optical lense subassemblies to a European firm, and its accounting software then

Table 6. NAMSA Costs to Repair TOW Optical Sights in 1982. [Given Various Exchange Rates]

FLux/US Dollar	$Mat'l	$Labor	$Total
28[7]	2230	1676	3906
40[8]	2230	1173	3403
52[9]	2230	902	3132
54.05[10]	2230	868	3098
58[11]	2230	809	3039

[7]At low point of dollar during Carter Administration.

[8]Actual at time of NUTAP.

[9]At time of study team visit to NAMSA.

[10]Projected by NATO for 1984/5/6.

[11]At highest point prior to study team visit.

summarized these contract costs as labor. Contrariwise, ANAD purchased new or like new subcomponents from the Army Stock Fund, turning in the unserviceable subcomponents for any authorized credit; hence, the Standard Depot System software recorded these purchases as materials. Thus, differences in maintenance procedures caused a variation in the cost accounting process, thereby invalidating all except total cost comparisons.

d. Costs from the NUTAP study (see Table 5) were used to investigate the impact on costs of repair under differing Franc Luxembourg (FLux)-to-dollar exchange rates. The costs per sight at various exchange rates are shown in Table 6. The fluctuations in total cost are diluted since it is only necessary to adjust the non-dollar related costs. (Parts and materials are assumed to be dollar costs and not subject to fluctuations.) In NUTAP, parts were two-thirds of the total cost; in repair of PCBs, parts should be only about one-third. Therefore, costs for repair of PCBs should fluctuate more.

3. Impact Considerations.

a. ANAD supports 83% of the worldwide TOW in-use density (as opposed to in-storage). The other 17% is in USAREUR, and most of the unserviceable generations from this theater are, or will be, repaired at the PIMR Branch (see Table 7 for TOW unserviceable returns for FY82). Since much of TOW in-use density is in the hands of the Army Reserve and National Guard, the non-USAREUR systems receive somewhat less wear and tear per system, consequently generating fewer unserviceables per system. If NAMSA were assigned the USAREUR

Table 7. FY82 Worldwide TOW
Unserviceable PCB Returns to ANAD

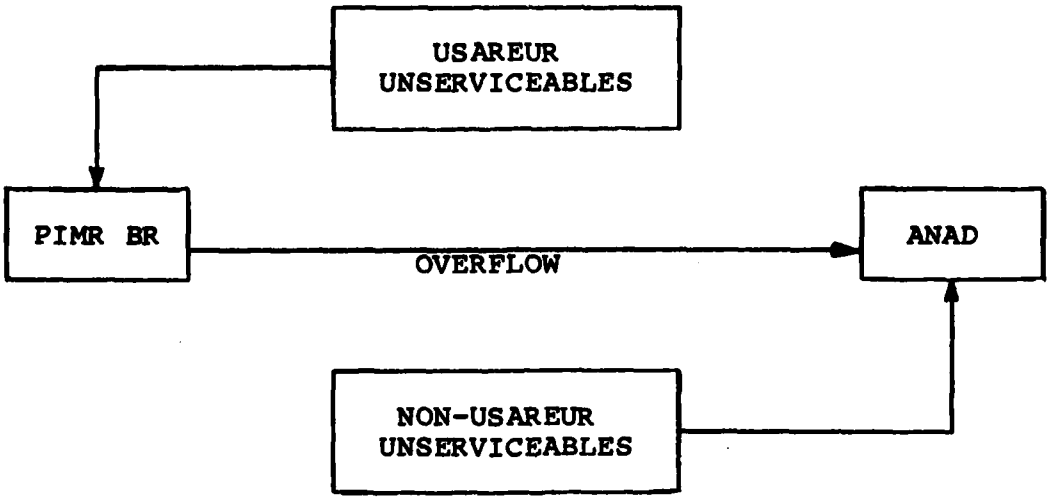
National Stock Number	USAREUR	NON-USAREUR
1430-00-464-1059	61	259
1430-00-464-1070	134	294
1430-00-490-0833	131	541
4935-01-012-0993	0	6
4935-01-012-9675[12]	0	16
Total	326	1116

[12]NSN 4935-01-012-9675 has been replaced by NSN 4935-01-066-0340; quantities are for the replacing NSN.

generated unserviceables, the PIMR Branch would lose an estimated 4.4 man-years of future workload. ANAD will lose USAREUR generations of TOW optical sights (Unserviceables generated in FY82: 111 each from USAREUR; 266 each from non-USAREUR), since they will be repaired in the future either by PIMR Branch or by NAMSA. ANAD will continue to receive from non-USAREUR sources sufficient TOW unserviceables to maintain skills, and a warm base in CONUS will not be lost. See Figure 6, page 56.

b. The LANCE density is considerably lower than the TOW with 75% of the in-use systems located in USAREUR. See Table 8 for LANCE unserviceable returns in FY82. If the USAREUR generated unserviceables were repaired by NAMSA and the balance by ANAD (see Figure 7, page 57), ANAD will be left with a 0.3 man-years of LANCE workload. Using forecast unserviceable requirements obtained from

CURRENT



PROPOSED

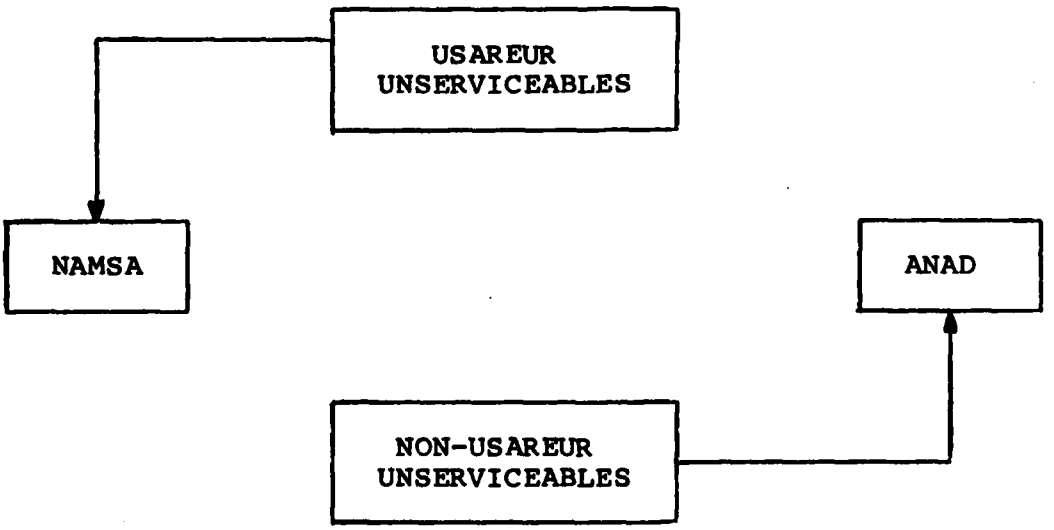


FIGURE 6. Repair of Worldwide TOW Unserviceable PCBs.

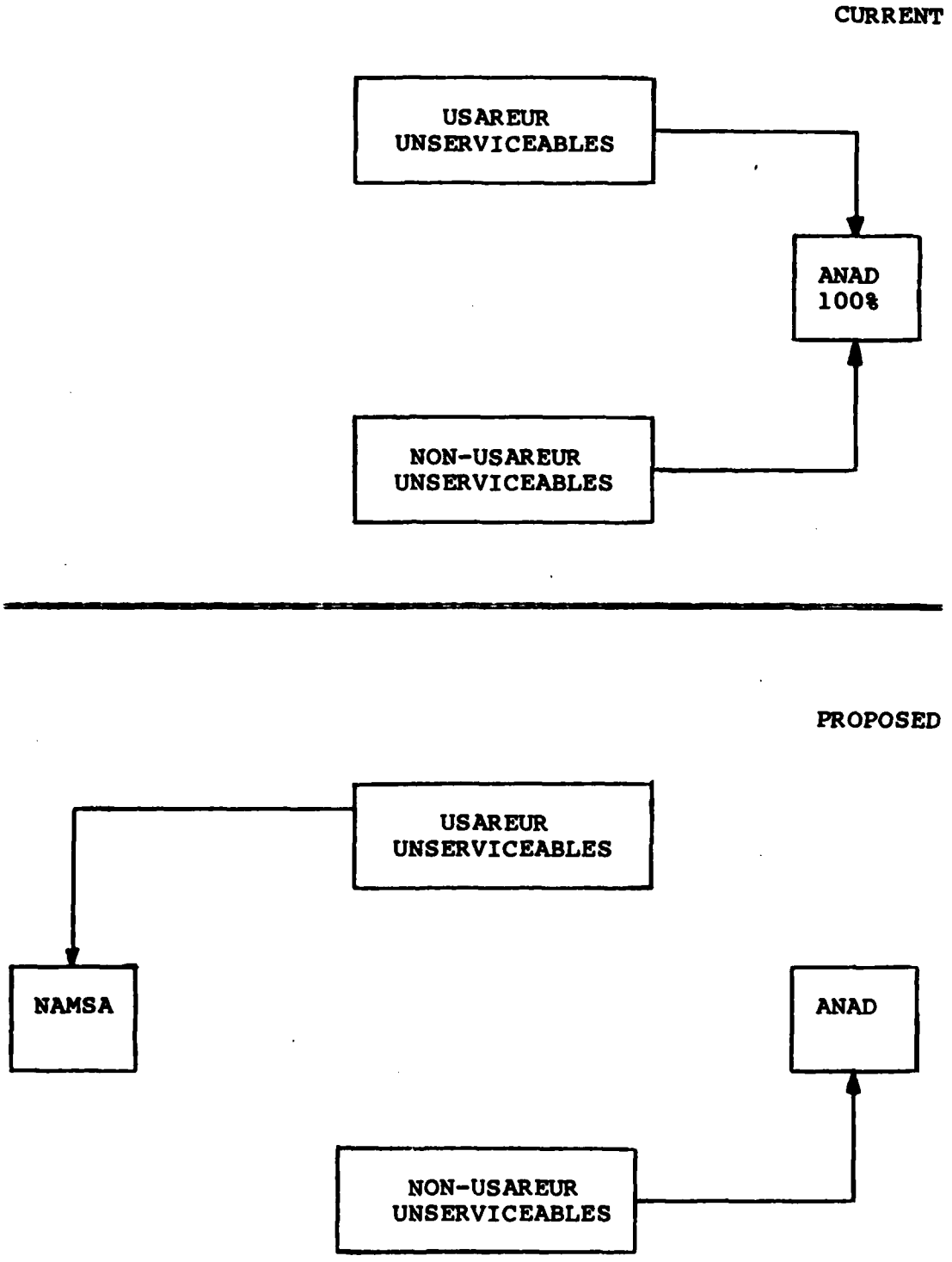


FIGURE 7. Repair of Worldwide LANCE Unserviceable PCBs.

the 200th TAMMC, NAMSA has estimated that depot level maintenance of one-half of USAREUR generated LANCE optics and electronics would require 0.3 man-years. All of the USAREUR unserviceable generations should then require 0.6 man-years. Assuming that ANAD and NAMSA work at near equal efficiency, using the Agency to repair all of USAREUR LANCE unserviceable generations will reduce the ANAD workload by about 0.6 man-years. Then, according to the definition of "warm base" used in this study, the remaining work should be sufficient to support the base to the degree necessary.

Table 8. FY82 Worldwide LANCE
Unserviceable PCB Returns to ANAD

National Stock Number	USAREUR	NON-USAREUR
1430-00-000-0087	35	19
1430-00-280-2175	4	3
1430-00-280-2180	10	8
1430-00-283-3498	8	5
4935-00-402-6950	13	8
Total	70	43

c. Force modernization items are increasingly incorporating sophisticated optical and electronic components. These items are usually deployed to USAREUR before other NATO nations receive the items and before NAMSA develops the capability for their repair. It is anticipated that the lost US workload, if the preceding suggestions are implemented, will be replaced through workload generated by force modernization items.

CHAPTER SEVEN

DISCUSSION AND CONCLUSIONS

1. Caveat emptor.

a. The cost analyses of the previous chapter were based on exchange rates prevalent at the time the data were accumulated, a time when the dollar was exceptionally strong against other NATO currencies. Only the free market has control over future exchange rates, which are influenced by such imponderables as the international balance of trade, monetization of national debts, the money supplies, and the interrelationships of all three. At the time of this writing, even the Congress is investigating the effects of continuing US budget deficits. NATO must have a projected flux/US dollar exchange rate for use in planning (54.Ø5 for 1984, 1985 and 1986); although the rate (calculated to two decimal positions) suggests accuracy, it should be accepted as only their best guess.

b. Historically, the dollar floated to its low point during the years of the Carter Administration, then to its high point during the current Administration. At present, imports are cheap while other countries find US exports expensive, causing a trade imbalance which will move the dollar downward.

c. As the value of the dollar drops on international markets, the relative cost of doing business with NAMSA and with MZAD will increase. "Buy American" may again become a slogan, perhaps even one to be enacted into law or regulation in order to defend the dollar.

d. If the Army approves extensive depot level repair overseas, including use of NAMSA and MZAD, eventually fewer spares for affected systems will be procured (based on a shortened pipeline). Then, if, in defense of the dollar, all except minimal repair is shifted to CONUS depots, with their extended repair cycles, a shortage of spares can severely degrade readiness.

e. The conclusion is that extensive depot level repair outside the US may lead to an unacceptable readiness posture in the long term, because of measures the government might undertake to defend the dollar. This conclusion is not supported in this study by citation of economic forecasts (at present, even the US President, his chief economist, and the Chairman of the Federal Reserve Board have not reached a concensus). But it has happened before, and it remains a distinct possibility.

2. Use of NAMSA in Peace and War.

a. The map of West Germany and Luxembourg (Figure 2, page 29) provides powerful motivation to plan for use of NAMSA during wartime. Two depot level repair facilities, strategically situated at different depths from the Fulda Gap, promise far more sustainability than does MZAD alone.

b. NAMSA has stated that it will repair US equipment during wartime insofar as possible, but that its capability to do so can be enhanced by increased use of its facilities during peacetime. This statement is further discussed in paragraph 11, page 65.

c. There is always some delay and confusion when changing systems and procedures. For this reason, systems and procedures to

be used by the US during wartime should be put in place and exercised to some extent during peacetime.

d. The conclusion drawn is that expanded use of NAMSA during peacetime will contribute to enhanced sustainability during wartime.

3. Quantities and Items.

a. NAMSA has an in-house depot level repair capability only for optics and electronics.

b. During the study team's visit to USAREUR, the most frequently mentioned figure for repair by NAMSA was 50% of that command's unserviceable generations. This figure was thought to be both acceptable politically and large enough to enhance the sustainability capability (refer to paragraph 2b on the previous page). It was also thought to be significant enough to improve USAREUR readiness.

c. LANCE and TOW have been selected for specific recommendations because the Agency is currently repairing these systems for NATO partnerships. NAMSA can also repair items used solely by the US, although the costs would not be reduced through sharing of test equipment with other NATO members. However, the establishment of a "fall-back" capability for other electronics and optics is both desirable and feasible.

d. Seventy-five percent of US worldwide in-use LANCE systems are deployed in USAREUR. LANCE is a low density weapon and its optics and electronics are highly reliable; both of these facts explain why few unserviceables are generated. In FY82, USAREUR generated two-thirds of worldwide LANCE unserviceables. Assignment

of only non-USAREUR generations to ANAD might result in degradation of the CONUS warm base to some extent. However, the CONUS warm base will not be required to expand as rapidly during a European war as will the NAMSA facilities. This point has been discussed in paragraph 4a, Chapter 4, page 32.

e. Generally, only those weapons which are in-use (as opposed to in storage) generate unserviceable optics and electronics. The US has 17% of its in-use TOW systems deployed in USAREUR, where they receive considerable wear and tear in training exercises. Significant quantities of the remaining in-use systems are in the hands of CONUS Army National Guard and Army Reserve units, where the wear and tear is significantly less. Assignment to NAMSA of 100% of USAREUR generations appears feasible.

4. Economic Considerations.

a. The cost comparison of Chapter Six shows that NAMSA operates efficiently and charges a fair price. However, whether the US perceives the price to be low or high will depend exclusively on the exchange rate between dollars and FLux. If the dollar falls below 40 FLux, NAMSA's services will likely be considered expensive. Above 45 FLux, the services will likely be considered a bargain.

b. The cost comparison between ANAD and NAMSA in the NUTAP indicates that near equality exists when the exchange rate is 40 FLux to the US dollar. When transportation costs and turn-around times are considered, NAMSA has a clear advantage. Even if NAMSA were at a cost disadvantage, the readiness and sustainability considerations discussed in earlier chapters support its use.

c. USAREUR TOW systems are being modernized by conversion from analog to digital circuitry. NAMSA will probably be unable to repair the whole range of TOW PCBs until the TOW WSP converts its own systems and establishes a repair capability at NAMSA.

5. Impact of NAMSA Utilization.

a. Using NAMSA to repair all of USAREUR TOW unserviceable generations will have an impact of 4.4 lost man-years on ANAD and the PIMR Branch together. Most of this reduced workload will befall the PIMR Branch. However, new force modernization items are constantly being deployed to USAREUR. For many of these, WSPs will not be formed or will be formed after US deployment. If support for these new items is assigned to the PIMR Branch, loss of the TOW repair business will not be significant.

b. Using NAMSA to repair all of USAREUR LANCE unserviceable generations will reduce the ANAD workload by about Ø.6 man-years. However, based on the definition of "warm base" used in this study, the remaining Ø.3 man-years should be sufficient to support the ANAD base to the degree necessary.

6. Lack of LANCE Repair Capability at MZAD.

a. MZAD's PIMR Branch presently lacks the equipment to repair LANCE PCBs, leaving NAMSA as the only European shop with this capability. To have only one facility on the continent equates to putting all of NATO's eggs in one basket.

b. Development of software and harnesses for computerized fault isolation for LANCE PCBs is preferable to manufacture of a new

set of LANCE peculiar test equipment. It is also the latest technology and is compatible with other test equipment.

7. MZAD's Lack of a Sustainability Capability. Currently MZAD uses US technicans in its PIMR Branch. If the optics and electronics shops were operated partly by qualified local nationals, the impact of most American civilians returning to CONUS on D-day could be mitigated.

8. Negotiation to Place US Technicians at NAMSA.

a. The Agency will negotiate with MICOM concerning staffing in accordance with NAMSO policy, which, among other things, requires that technicians be highly qualified. The political impact of expanding use of NAMSA can be mitigated if technicians could be sent to Luxembourg rather than laid off.

b. Depending on the outcome, it may be possible that MICOM can furnish personnel from Letterkenny and Anniston Army Depots in the same flexible manner in which the former PIMR Activity was staffed.

9. Missile Repair Technicians Returning to the US. Those US technicians in Europe who elect to return to the CONUS after D-day should increase the pool of qualified personnel available to the CONUS repair shops. Hence, the need for new, untrained employees should be reduced.

10. The Standard Depot System Software. Design of a truly effective system for peacetime use of both NAMSA and the missile repair branch of MZAD cannot efficiently be accomplished until MZAD installs the Standard Depot System software in 1986. The stock at

MZAD should look, to the MICOM computer, exactly like stock at ANAD, with all repair decisions being made by the one national item manager and all failure data being accumulated within the files of the Commodity Command Standard System for accurate computation of war reserve stockage requirements.

11. Build-up after D-day. Although CONUS depots will have some time to train additional personnel, as unserviceable items are slowly returned after D-day through the long transportation pipeline, MZAD and NAMSA can anticipate an almost immediate increase in workload. The conclusion is that these latter two organizations require more peacetime technicians than do CONUS depots to respond to a surge. There is merit to NAMSA's statement that US business is needed in peacetime to create an adequate wartime capacity.

12. Readiness. Improvements in readiness will be initially noted if more depot level repair is performed in-theater. However, as the software used by the supply system responds to the reduced repair times, fewer replacement items will be procured and readiness should return to its present level. Although expanded use of in-theater depot level repair can trim procurement costs, the savings may well be applied to support of equipment other than missile electronics and optics. Still, although long-term readiness improvement cannot be cited as justification for in-theater repair, the cost savings can. Refer to Figure 3, page 33.

13. Contingency Planning. No plans exist for sharing of equipment, workload, facilities, or technicians between MZAD and NAMSA in event of war. These are areas ripe for discussion which could

lead to improved preparedness for NATO as a whole (including USAREUR).

14. Competition. Use of NAMSA will introduce another element of competition into the depot system. Since missile repair facilities are all non-profit, this competition should cause improved repair times and lower repair costs through increased efficiency.

15. Obligation to use NAMSA. The US contributes heavily to NATO but these funds do not appreciably subsidize the NAMSA operations[9]; the NATO contributions are principally sunk costs, and expanding use of NAMSA will recover little of them. No legal obligation to use NAMSA exists. The US espouses Rationalization, Standardization, and Interoperability, but it is questionable how much of a moral obligation this creates. NAMSA has remained in business since 1958 by doing work more efficiently than could be done by any single NATO member alone; otherwise the individual NATO countries would have done the work in-country. NAMSA does not need US repair work to remain in business; hence, there is no obligation from this viewpoint. Of course, the US is obligated to expanded use of NAMSA if such use is in its own self-interest.

16. Limits to Host Country Support. Up to $75 Million, chargeable as host country support, can be spent each year by the US European Command in procurement of petroleum. The total limit on this

[9]The Headquarters element of NAMSA is NATO-funded and its personnel costs are not charged to customers. In a sense this is equivalent in the US to an Army industrially funded depot which does not charge its customers for unfunded military labor costs, Foreign Military Sales cases excepted.

support, imposed by the NATO Mutual Support Act, is $100 Million. It seems prudent to ask that NAMSA repair be excluded from the category of host country support, or, failing that, the limit be increased. The proper time for such a request is the present, before support spending gets too close to the limit.

17. WSP Enabling Legislation. No recommendation is being made in this study concerning legislation to enable entry into WSP committees. It is anticipated that this problem will be resolved shortly by the MLRS Project Manager.

18. Procurement by NAMSA on Behalf of the US.

a. USAREUR's procurement actions are presently performed by the US Army Contracting Agency, Europe. During peacetime, competition is adequate to assure reasonable prices.

b. However, during wartime (when all essential industries are operating at maximum capacity), USAREUR and NAMSA may be bidding against each other, and thereby driving up prices. US Forces need to use NAMSA procurement to a limited extent (for familiarization) during peacetime and without limits during wartime.

c. There is economy of scale to be achieved if the US pools its requirements with those of the other NATO members. (Refer to paragraph 2a on page 16.) Presently there is no way of identifying requirements for goods and services suitable for pooling.

19. Buying into Weapon System Partnerships. Now is the ideal time for negotiating costs to buy into partnerships in which the US desires membership (the preferred way of using NAMSA). The

current strength of the dollar in international markets will make the buy-in price cheaper.

20. Procurement Appropriation Funded Spares.

a. There are two types of items available to US repair shops - repair parts (which are relatively inexpensive and which are customarily stock funded) and spares (which are relatively expensive assemblages and which are customarily funded by procurement appropriations). If NAMSA requisitions either class of item, it is paid for from their funds and subsequently resold at the Agency's price to its customer. During its European visit, the study team was told that the Agency "always" repairs using only piece parts (stock funded type items). The team believes that "almost always" would have been a more appropriate expression.

b. If NAMSA should buy or fabricate a procurement funded ("free issue") type of item, it would be a violation of the "one item, one manager" rule in that a spare would be entering the US inventory without the approval or even the knowledge of the national item manager. Furthermore, the Operations and Maintenance, Army, appropriation would be funding the spare even though it was a "free issue" item. A procedure would have to be developed whereby the Agency could obtain such spares without charge, leaving an audit trail to assure that the "free issue" item was used in US equipment, and that the US was charged only overhead expenses for handling of the spares.

21. Advance Payments. For the ongoing calibration agreement with NAMSA, the US pays on the first of each month for the work to

be done during that month. This seems to be a parsimonious policy, perhaps expected of a poor country. Somewhere there must be financial logic undiscovered by the study team.

22. Prime Considerations in Arriving at Recommendations.

a. NAMSA facilities and personnel are equal in capability to MZAD and ANAD. First, its geographical location and, second, its policies, make it a superior candidate for support of USAREUR sustainability. These are compelling reasons for expanding its use.

b. Uncertainty, with respect to future flux/US dollar exchange rates, is the only good (but not a compelling) reason for not expanding use of the Agency.

23. Execution.

a. Execution of the recommendations require long lead times, but all can begin concurrently.

b. As an interim measure, negotiation can begin for depot level equipment repair to be done of the basis of man-hours, materials, and equipment use charge.

24. Summary of this Chapter. Expanded use of NAMSA will:

a. Bring about only minor improvement in long range readiness.

b. Lead to some savings on spares procurement.

c. Enhance the sustainability of USAREUR forces.

CHAPTER EIGHT

RECOMMENDATIONS

1. Expanded use of NAMSA.

a. Unserviceable TOW and LANCE electronic and optical items generated by USAREUR and requiring depot level maintenance should be repaired by NAMSA. Non-USAREUR generations should be repaired by ANAD. The US should buy into the TOW and LANCE WSP committees.

b. Negotiations for NAMSA repair of a minimal quantity of other depot level reparables in the electronics and optics area should be initiated by DARCOM. The quantity selected should be sufficient to familiarize US managers with the NAMSA procedures, so that lack of knowledge will not hinder increased usage during wartime.

c. As work is assigned to NAMSA, DARCOM (MICOM in particular) should negotiate for placement of US technicians at NAMSA in proportion to the amount of US business assigned to the Agency.

d. MZAD should develop contingency plans with NAMSA so that, if either is destroyed or severely damaged during wartime, the other can handle the complete NATO workload insofar as optical and electronic items are concerned.

e. After installation of the Standard Depot System software at MZAD, items coded as depot level reparable should be stocked in a MICOM owned and controlled account.

f. DARCOM should form a steering committee to develop, coordinate and publish policy with regard to use of NAMSA.

2. Legislation. DARCOM should sponsor legislation removing the NAMSA workload from the $100 million limit on host country support.

If this is infeasible, legislation should be sponsored to increase the limit. If even this is infeasible, then legislation should be prepared and shelved so that it can immediately be presented to the Congress when the need occurs.

3. Other.

a. Software for fault-isolation by computer, for LANCE electronics, should be developed and supplied to MZAD. This depot would then be prepared to repair LANCE unserviceables generated within theater during wartime if such should become necessary.

b. MZAD should consider the employment of some European national technicians in the missile and optics area to assure a capability after D-day.

c. DARCOM and USAREUR should identify those goods and services for which requirements can best be filled by pooling with other NATO members. NAMSA should then be used for such procurement services.

APPENDIX A

ACRONYM LIST

AMDF	Army Master Data File
ANAD	Anniston Army Depot
CONUS	Continental United States
DARCOM	Army Materiel Development and Readiness Command
D-DAY	Day on which hostilities in Europe are initiated
DESCOM	Depot System Command
DRAGON	Anti-tank Missile
FLux	Luxembourg Francs
FY	Fiscal Year, 1 Oct to 30 Sept
GROUND TOW	Anti-tank Missile, fired from ground
HAWK	Air Defense Missile
I-HAWK	Improved HAWK
LANCE	Large Surface-to-Surface Guided Missile
MICOM	Army Missile Command
MLRS	Multiple Launch Rocket System, Surface-to-Surface
MZAD	Mainz Army Depot
NAMSA	NATO Maintenance and Supply Agency
NAMSO	NATO Maintenance and Supply Organization
NATO	North Atlantic Treaty Organization
NIKE	Air Defense Missile
NUTAP	NAMSA Utilization Test Action Plan
PCB	Printed Circuit Board
PIMR	Pirmasens Missile Repair
STINGER	Air defense missile
TAMMC	Theater Army Materiel Management Center
TOW	Anti-tank missile
TOW/COBRA	Helicopter-mounted TOW
USAREUR	U.S. Army Europe
WSP	Weapon System Partnership

APPENDIX B

ILLUSTRATION OF BIAS IN COSTING BOARD REPAIR

1. Let us assume that in USAREUR a five year old black box containing PCBs "A", "B" and "C" becomes unserviceable. The box is taken to the PIMR Branch, tested with US-manufactured general support equipment, and PCB "A" is identified as the malfunctioning board. The board is replaced by a new or like new PCB from the direct exchange pool. The customer leaves with a serviceable black box containing one board which currently meets the manufacturer's specifications and two boards which met the same specifications five years ago. The unserviceable board is shipped to ANAD for repair. At ANAD, the shop replaces every component which fails to meet the original specifications, thereby bringing the board to a condition as good as new. In this example, let us assume that $100 in parts and 10 hours direct labor were used, that direct labor costs are $12 per hour, and other costs, excluding depreciation, are $13 per hour. ANAD enters this cost, a total of $350, into their cost accounting system, as follows:

Table B-1. Printed Circuit Boards
Anniston Army Depot

Box	A	B	C
1st	350	-	-

2. Next, let us assume that forces of the United Kingdom have a like unserviceable black box with the same defect in the same

board. The black box itself is shipped to NAMSA, since other NATO countries did not purchase general support test equipment. All three boards are removed and tested, with any part not meeting the manufacturer's specifications being replaced. The black box, which now contains three PCBs currently meeting specifications, is returned to the customer. Board "A" required $100 in parts and 10 hours labor at $25 per hour; boards "B" and "C" each required $5 worth of capacitors and resistors whose electrical values (because of age) had drifted just outside of specifications, and each board required 2 hours of testing and repair. NAMSA makes the following entries in their cost accounting records:

Table B-2. Printed Circuit Boards

NAMSA

Box	A	B	C
1st	350	55	55

3. Next, let us assume that two more like black boxes, one owned by the US and one by the United Kingdom, fail because of defective "B" boards. (Substitute "B" for "A" in the two preceding paragraphs.) The cost data after repairs have been made and records posted look like Table B-3 on the opposite page:

Table B-3. Printed Circuit Boards

Anniston Army Depot				NAMSA			
Box	A	B	C	Box	A	B	C
1st	350	-	-	1st	350	55	55
2nd	-	350	-	2nd	55	350	55

4. Next, as before, let us assume the same countries and like black boxes, but failure of the "C" boards. The cost data follows:

Table B-4. Printed Circuit Boards

Anniston Army Depot				NAMSA			
Box	A	B	C	Box	A	B	C
1st	350	-	-	1st	350	55	55
2nd	-	350	-	2nd	55	350	55
3rd	-	-	350	3rd	55	55	350

5. Last, let us assume an analyst requests mean (average) cost data from both locations. Shown below are the data that he would be furnished:

Table B-5. Printed Circuit Boards

Anniston Army Depot				NAMSA			
Box	A	B	C	Box	A	B	C
1st	350	-	-	1st	350	55	55
2nd	-	350	-	2nd	55	350	55
3rd	-	-	350	3rd	55	55	350
Mean	350	350	350	Mean	153	153	153

6. The conclusion drawn is that unlike maintenance policies prevent valid cost comparisons even at the board level. That the policies differ has been verified by telephone calls to NAMSA and ANAD.

END

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